

HUMAN SPACE FLIGHT
FISCAL YEAR 2001 ESTIMATES
BUDGET SUMMARY

OFFICE OF SPACE FLIGHT

INVESTMENTS AND SUPPORT

SUMMARY OF RESOURCES REQUIREMENTS

	FY 1999 OPLAN <u>12/23/99</u>	FY 2000 OPLAN <u>REVISED</u> (Thousands of Dollars)	FY 2001 PRES <u>BUDGET</u>	Page Number
Rocket Propulsion Test Support.....	[23,659]	[24,500]	28,000	HSF 5-3
OSF Contributions to Academic Programs.....	[3,128]	[3,100]	8,000	HSF 5-5
Advanced Projects	[15,000]	[--]	--	
Technology and Commercialization	[--]	[--]	20,000	HSF 5-7
Engineering and technical base	<u>[90,672]</u>	<u>[79,300]</u>	<u>73,500</u>	HSF 5-10
 Total.....	 <u>[132,459]</u>	 <u>[106,900]</u>	 <u>129,500</u>	
 <u>Distribution of Program Amount by Installation</u>				
Johnson Space Center	[46,329]	[22,331]	30,800	
Kennedy Space Center.....	[13,460]	[12,903]	12,800	
Marshall Space Flight Center	[49,896]	[40,500]	37,800	
Stennis Space Center	[19,591]	[20,000]	23,300	
Ames Research Center	[300]	[--]	--	
Glenn Research Center.....	[450]	[--]	--	
Langley Research Center.....	[1,385]	[--]	--	
Goddard Space Flight Center	[400]	[--]	--	
Jet Propulsion Laboratory	[500]	[--]	--	
Headquarters	<u>[150]</u>	<u>[11,166]</u>	<u>24,800</u>	
 Total.....	 <u>[132,459]</u>	 <u>[106,900]</u>	 <u>129,500</u>	

Note - FY 1999 and FY 2000 data in this section are for comparison purposes only. See Payload Utilization and Operations sections for more details.

PROGRAM GOALS

There are several goals in the Investments and Support. They range from supporting rocket propulsion test support, supporting for NASA's academic programs, to ensuring maximum return on the research investment, to reducing operations costs, to continuing to implement flight and ground systems improvements, and to supporting strategic investments in advanced technology needed to meet future requirements and enabling synergistic commercial space development efforts.

STRATEGY FOR ACHIEVING GOALS

The Investments and Support budget reflects a commitment to meet a wide array of programs. The principal areas of activity in the Investments and Support program are: 1) provide leadership in the area of rocket propulsion testing, 2) provide additional support to NASA's academic programs, 3) within Technology and Commercialization to develop and promote space commercialization and technology transfer, and; 4) within Engineering and Technical Base (ETB), empower a core workforce to operate Human Space Flight laboratories, technical facilities, and test beds, and stimulate science and technical competence in the United States, and maintenance of an institutional base from which to perform NASA programs at reduced cost through re-engineering, consolidation and operational efficiency processes.

The Investments and Support budget is a new budget line item in the FY 2001 budget. Funding for this new budget line, with the exception of the Technology and Commercialization program, will be established from programs previously funded in the Human Space Flight and Mission Support Appropriations. Specifically, the Engineering and Technical Base was previously funded from the Payload Utilization and Operations budget line item in FY 1999 and FY 2000. The Enterprise Contribution to Academic Programs was previously funded from both Space Shuttle and Payload Utilization and Operations. The Rocket Propulsion Test Program was previously funded in the following BLIs: Space Shuttle, Engineering and Technical Base, Space Station and Research and Program Management (R&PM). The Technology and Commercialization project is a new start for FY 2001. Beginning in FY 2001, all of these projects will be funded from this new budget line item.

BASIS OF FY 2001 FUNDING REQUIREMENT

ROCKET PROPULSION TEST SUPPORT

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>
		(Thousands of Dollars)	
Rocket Propulsion Test Support	[23,659]	[24,500]	28,000

PROGRAM GOALS

A new Budget Line Item (BLI) has been established beginning in FY 2001 to ensure NASA's rocket propulsion test capabilities are properly managed and maintained in world class condition. The Rocket Propulsion Test Support Program is not a new activity, but a consolidation of ongoing activities to achieve a more effective test program. The Rocket Propulsion test Program was previously funded in the following BLIs: Space Shuttle, Engineering and Technical Base, Space Station and Research and Program Management (R&PM). This consolidation will significantly enhance NASA's ability to properly manage our rocket testing activities and infrastructure.

STRATEGY FOR ACHIEVING GOALS

Stennis Space Center (SSC) has been appointed as Lead Center for Propulsion Testing to manage this initiative, which includes making test assignments and approval of test facility investments. Funding for this program provides:

- 1) sustaining support for propulsion test facilities which include test positions and related infrastructure at SSC, JSC-WSTF, GRC-PB and MSFC;
- 2) modernization/upgrades of existing facilities to ensure their capabilities are adequate to meet the demands of our future customers and to optimize their operating efficiency;
- 3) administrative/technical support to SSC for scheduling and management of propulsion testing across the agency and coordination of these activities with DoD and commercial customers; and
- 4) development of test technologies to improve analytical capabilities, hardware health monitoring, and operational safety and achieve cost savings through enhanced operational efficiencies.

NASA has established a Rocket Propulsion Test Management Board (RPTMB) under Stennis Space Center purview, which is NASA's Lead Center for Rocket Propulsion Testing. The RPTMB is composed of representatives from all four NASA rocket test centers (SSC, MSFC, JSC-White Sands and GRC-Plum Brook) and is chaired by SSC. The RPTMB has established baseline test roles for each center, resulting in the consolidation of test capabilities and the elimination of redundant facilities and related infrastructure. The roles are tailored to take advantage of existing unique capabilities at each site and to consolidate capabilities where it makes sense. The RPTMB makes test assignments, controls investments, and manages personnel and equipment sharing among NASA's test sites.

In addition, NASA has been key to the formation and development of the National Rocket Propulsion Test Alliance (NRPTA). NASA and DoD test sites are cooperating to share people and equipment, review/track investments, and make interagency test

assignments that will improve test support and avoid redundant investments in federally owned and operated test facilities. The NRPTA maintains an integrated national rocket test facility schedule and utilization rate, along with detailed data on NASA/DoD test facility capabilities.

SCHEDULE AND OUTPUTS

Improve NASA test capabilities through modernization and upgrades of various test facilities

Improve altitude system capability and efficiency Plan: 4 th Qtr FY 2000	Improve altitude system capability and efficiency at JSC-WSTF and GRC-PB
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High-pressure spares and equipment upgrades Plan: 3 rd Qtr FY 2000	Provide critical high-pressure spares and equipment upgrades for E Complex at SSC
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Improve NASA test capabilities and achieve cost savings by implementation of planned facility readiness/closure plans

Commercial Operations Plan: 2 nd Qtr FY 2000	Complete integration of commercial operations on test stand B-1 at SSC
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Activate cells 2 and 3 of E-1 at SSC Plan: 4 th Qtr FY 2000	
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Mothball test stand 4670 at MSFC Plan: 3 rd Qtr FY 2000	Mothball test stand 4670 at Marshall Space Flight Center
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Enhance test diagnostics capabilities and increase operational efficiencies through implementation of new test technologies.

H2 Leak Detection System Plan: 4 th Qtr FY 2000	Develop improved H2 Leak Detection System for A/B test stand at Stennis Space Center
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Development of plume diagnostics Plan: 4 th Qtr FY 2000	Complete development of plume diagnostics research activities to detect metals in exhaust plumes
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Modular test hardware Plan: 4 th Qtr FY 2000	Initiate development of modular test hardware prototype
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Advanced data acquisition	Complete advanced data acquisition and controls development laboratory
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and controls development
laboratory

Plan: 4th Qtr FY 2000

Improve coordination/management of propulsion testing between NASA and DoD via efforts by the Rocket Propulsion Test Management Board (RPTMB)

Scheduling/integration tools and processes Develop improved scheduling/integration tools and processes

Plan: 4th Qtr FY 2000

NASA/DoD cross-agency test assignments Achieve six NASA/DoD cross-agency test assignments

Plan: 4th Qtr FY 2000

Integration and assignment process in conjunction with DoD Establish test integration and assignment process in conjunction with DoD

Plan: 4th Qtr FY 2000

Increase the number of Air Force test personnel Increase the number of Air Force test personnel at SSC from 1 to 3

Plan: 4th Qtr FY 2000

Ongoing Measures of Performance:

- 1) Improve NASA test capabilities through modernization and upgrades of various test facilities
 - a. Improve thrust measurement capability at selected test positions
 - b. Upgrade Test Complex Control Room systems and equipment at various test positions
- 2) Improve NASA test capabilities and achieve cost savings by implementation of planned facility readiness/closure plans
 - a. Demonstrate two-day turnaround on all major test projects
 - b. Ensure less than 5% of tests are delayed by facility problems
- 3) Enhance test diagnostics capabilities and increase operational efficiencies through implementation of new test technologies
 - a. Develop non-intrusive instrumentation and controls

ACCOMPLISHMENTS AND PLANS

Over the last two years, decisions made and actions taken by NASA's Rocket Propulsion Test Management Board (RPTMB) has resulted in an estimated total savings of approximately \$37 million, while the National Rocket Propulsion Test Alliance (NRPTA) has contributed another \$10 million. To date, the RPTMB has made 25 propulsion test assignments within NASA, across other agencies, and to industry facilities where it was in the best interest of NASA. During FY 2001, the agency will implement critical

facility upgrades to ensure existing test assets are truly the best in the world, providing flexible and robust testing capabilities operated by a highly experienced and trained cadre of test personnel. The RPTMB will continue to make test assignments that optimize utilization of existing test facilities across the agency and achieve further cost savings. Efforts will also continue in the upcoming fiscal year to execute planned facility closures and activate test facilities currently being modified in preparation for planned testing in FY 2001 and beyond. Investments in new test technologies such as exhaust plume diagnostics and H2 leak detection will enhance our ability to monitor the status of hardware during testing and increase operational safety. Investments will also be made in the development of improved scheduling tools, test technology, and modularization of test support hardware to reduce turnaround times, improve test management capabilities and improve overall operational efficiencies.

BASIS OF FY 2001 FUNDING REQUIREMENT

OSF CONTRIBUTION TO ACADEMIC PROGRAMS

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>
	(Thousands of Dollars)		
OSF Contribution to Academic Programs	[3,100]	[3,100]	8,000
Education Programs.	[--]	[--]	[2,500]
Minority University Research and Education Programs	[3,100]	[3,100]	[5,500]

PROGRAM GOALS

The goal of the Office of Space Flight (OSF) Contribution to Academic Programs is to provide additional funding to support NASA direction for academic programs as set forth in the NASA Strategic Plan as one of the Agency's five contribution to the Nation's science and technology goals and priorities.

STRATEGY FOR ACHIEVING GOALS

In carrying out its Education Program, NASA is particularly cognizant of the powerful attraction the Human Exploration and Development of Space (HEDS) mission holds for students and educators. The unique character of the Human Exploration and Development of Space (HEDS) Strategic Enterprise's exploration, scientific, and technical activities has the ability to captivate the imagination and excitement of students, teachers, and faculty, and channel this into an investment which support NASA's Education Program.

In fulfilling its role to support excellence in education as set forth in the NASA Strategic Plan, the NASA Education Program brings students and educators into its missions and its research as participants and partners. NASA provides the opportunity for educators and students to experience first hand involvement with the Human Exploration and Development of Space (HEDS) Enterprise scientists and engineers, facilities, and research and development activities. Examples of such opportunities include the Learning Technologies Program, a new Undergraduate Internship Program, and the Graduate Student Researchers Program. The participants benefit from the opportunity to become involved in research and development endeavors, gain an understanding of the breadth of HEDS activities, and return to the classroom with enhanced knowledge and skills to share with the entire education community. Detail as to how this funding is utilized is located under the NASA Education portion of the budget.

The Human Exploration and Development of Space (HEDS) Strategic Enterprise investments in higher education institutions include Federally mandated outreach to the Nation's Historically Black Colleges and Universities (HBCUs) and Other Minority Universities (OMUs), including Hispanic-Serving Institution and Tribal Colleges and Universities. This outreach is achieved through a comprehensive and complementary array of strategies developed in collaboration with the Office of Equal Opportunity Programs. These strategies are designed to create a broad-based, competitive aerospace research capability within Minority Institutions (MI's). This capability fosters new aerospace science and technology concepts by integrating HEDS Enterprise-related cutting-edge science and technology concepts, practices, and teaching strategies into MI's academic, scientific and technology infrastructure. As result, increasing the production of more competitive trained U.S. students underrepresented in NASA-related

fields who, because of their research training and exposure to cutting-edge technologies, are better prepared to enter graduate programs or the workplace. Other initiatives are focused on enhancing diversity in the HEDS Strategic Enterprise's programs and activities. This includes exposing faculty and students from HBCUs and OMUs, and students from under-served schools, with significant enrollments of minority students, to the Enterprise's research efforts and outcomes, educational programs, and activities. To support the accomplishment of the Enterprise's mission, these programs are implemented through NASA Centers and JPL. The Centers and JPL support the MUREP through use of their unique facilities, program management and grant administration, and commitment of their personnel to provide technical assistance and assist in other facets of program implementation. Extensive detail as to how this funding is utilized is located under the MUREP portion of the budget.

The Office of Life and Microgravity Sciences and Applications (OLMSA) is also making a contribution to academic programs as part of the HEDS Enterprise. Details can be found in the Life and Microgravity Sciences and Applications section.

SCHEDULE AND OUTPUTS

Extensive detail as to how this funding is utilized is located under the Academic Programs portion of the budget.

ACCOMPLISHMENTS AND PLANS

Extensive detail as to how this funding is utilized is located under the Academic Programs portion of the budget.

BASIS OF FY 2001 FUNDING REQUIREMENT

TECHNOLOGY AND COMMERCIALIZATION

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>
	(Thousands of Dollars)		
HEDS Technology and Commercialization.....	--	--	20,000

PROGRAM GOALS

The goals of the Human Exploration and Development of Space (HEDS) Technology/Commercialization Initiative (HTCI) are four-fold. First, the HTCI will support HEDS analysis and planning for safe, affordable and effective future programs and projects that advance science and discovery, human exploration, and commercial development of space. Second, the Initiative will pursue research, development, and validation of breakthrough technologies and highly innovative systems concepts that open up new and potentially revolutionary system-, infrastructure- and architecture- level options for HEDS. The HTCI will pursue technologies, systems and infrastructures that enable synergistic advancement of science-driven integrated human-robotic space exploration, as well as the commercial development of space. Finally, the Initiative will improve the affordability and the effectiveness with which HEDS will be able to achieve it's strategic objectives in the future by creating strong partnerships within NASA, with US industry and universities, and with international partners. By achieving these goals, the HEDS Technology/Commercialization Initiative will support better informed decisions by policy-makers concerning a) further research and technology development investments, and b) prospective future HEDS exploration initiatives and related capabilities and infrastructures. It will also make high-leverage, high-risk incremental progress toward innovative systems concepts and breakthrough technologies that could support market-driven, private sector decisions concerning commercial development of space.

STRATEGY FOR ACHIEVING GOALS

The strategic approach to accomplish the program goals of the HTCI involves three types of activities. First, HTCI will conduct systems analysis and advanced concept studies. These activities will include the formulation and refinement of new approaches (e.g., architectures, technologies, etc.) and the identification/refinement of advanced systems concepts in order to dramatically increase safety while reducing mission risk and cost for future prospective HEDS programs. Second, the Initiative will undertake HEDS-enabling advanced research and technology (HART) projects. These will be competitively selected (with a goal of 50% cost share from Industry, where appropriate), and will emphasize increases in safety, reduced risks and costs, and enabling new opportunities. Wherever possible, HART Projects will leverage other resources (including investments within NASA, other US government, industry, academia, internationally, etc.). Finally, the HTCI will conduct flight demonstration projects (including small missions, if funding permits). These flight projects will involve "new millennium-type" experiments for small robotic missions, on the International Space Station, or other carriers. This area will include resources for the development of competitively selected HEDS payloads for inclusion in Office of Space Science (OSS) Mars missions, as well as other flight projects that will be competitively selected (with a goal of 50% cost share from Industry, where appropriate).

SCHEDULE AND OUTPUTS

Systems Analysis and Advanced Concepts Studies - Activities supporting System Analysis and Advanced Concepts Studies will be integrated with the NASA Research Announcements (NRAs) supporting HEDS-enabling Advanced Research and Technology (HART) projects, as summarized below.

HEDS-enabling Advanced Research and Technology (HART) Projects

'01HEDS-enabling Research and Technology (HART) NASA Research Announcement Plan: 1 st Qtr FY 2001	Initial solicitation of HEDS systems studies and HART technology projects; coordinated with planning for later flight demonstration projects/options.
'01HEDS-enabling Research and Technology (HART) NRA Project Announcements Plan: 3rd Qtr FY 2001	Announcement of awards from initial HART NRA.
'02 HEDS-enabling Research and Technology (HART) NASA Research Announcement Plan: 1 st Qtr FY 2002	Second solicitation of HEDS systems studies and HART technology projects; coordinated with planning for later flight demonstration projects/options.

Flight Demonstration Projects

'01HEDS Technology/Commercialization Initiative NASA Research Announcement for Flight Demonstration Projects Plan: 4 th Qtr FY 2001	Initial solicitation of HEDS flight demonstration projects, focusing on demonstration project definition studies; coordinated with HCTI studies and HART technology projects.
'01HEDS Technology/Commercialization Initiative NRA Flight Demonstration Project Definition Study Announcement Plan: 2 nd Qtr FY 2002	Initial solicitation of HEDS flight demonstration projects, focusing on demonstration project definition studies; coordinated with HCTI studies and HART technology projects.

ACCOMPLISHMENTS AND PLANS

During FY 1999 the Office of Space Flight (OSF) Advanced Projects Office (APO) conducted preliminary, largely in-house studies and assessments of human exploration mission and technology options under the funding for the Engineering and Technical Base (ETB). These efforts continued in FY 2000 as reflected in the ETB section of the Launch Vehicles and Payloads Operations budget narrative. During Fiscal Year 2001, the OSF APO will implement the HEDS Technology/Commercialization Initiative, including competitively selected activities and specific in-house activities. Preliminary validation of technologies at the component level will be accomplished, as well as planning for potential future investment options. Flight Demonstration Project options will be defined, as well as implementation of HEDS experiments for the Office of Space Science Mars's missions, as appropriate.

BASIS OF FY 2001 FUNDING REQUIREMENT

ENGINEERING AND TECHNICAL BASE

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>
		(Thousands of Dollars)	
Engineering and technical base	[90,672]	[79,300]	73,500

PROGRAM GOALS

The focus of the Engineering and Technical Base (ETB) is to support the institutional capability in the operation of space flight laboratories, technical facilities, and testbeds; to conduct independent safety, and reliability assessments; and to stimulate science and technical competence in the United States. ETB activities are carried out at the Johnson Space Center (JSC) including White Sands Test Facility (WSTF), Kennedy Space Center (KSC), Marshall Space Flight Center (MSFC), and Stennis Space Center (SSC). ETB funds are used to: maintain the Centers' technical competence and ability to perform research; analysis and testing tasks; to solve present problems; and to reduce costs in developing programs, technologies, and materials. Efforts include system and mission analysis, integrated HSF Research and Technology (R&T) requirements definition and integration, modest R&T investments in an EVA technology demonstration project and investments in R&T required to support the integrated Office of Space Science/HEDS robotic efforts.

STRATEGY FOR ACHIEVING GOALS

The complex and technically challenging programs managed by the Office of Space Flight (OSF), now and in the future, are most effectively carried out by sustaining a NASA "core" institutional technical base. It is vital to preserve essential competency and excellence. Since FY 1994, the OSF centers have consolidated activities and have identified ways to economize the resources committed to ETB while maintaining ETB's benefits to the nation's human space flight program. Over the next few years, this consolidation will continue to generate savings through improved information resources management and contract streamlining. A prioritized core capability will include multi-program labs and test facilities, associated systems, equipment, and a full range of skills capable of meeting research, testing and simulation demands.

Several ETB activities will continue to seek out efficiencies and cost savings, by refining current business practices. Mandatory equipment repair and replacement will be reassessed. Software applications for multi-program analytical tools will be implemented. The strategy to better manage the NASA investment in information processing resources includes aggressive actions to integrate and consolidate more ADP operations. ETB will ensure synergism among major NASA engineering programs. Awards for education and research tasks will be granted to support educational excellence and research learning opportunities in colleges and universities. A key challenge of the ETB strategy will be to provide a core capability for future human space flight endeavors with fewer resources. Adoption of new innovative processes to meet critical ETB core requirements and streamlining or eliminating non-critical capabilities will enable future savings.

SCHEDULE AND OUTPUTS

Laboratories & facilities supported (KSC)	Maintains 11 science and engineering laboratories in support of 6 agency programs
Laboratories & facilities supported (JSC)	Maintains 156 science and engineering laboratories in support of 52 agency programs
Laboratories & facilities supported (MSFC)	Maintains 123 science and engineering laboratories and facilities in support of 42 agency programs
Laboratories & facilities supported (SSC)	Maintains 3 science and engineering laboratories in support of 2 agency programs
NASA Minority University Research and Education Program at JSC, KSC, MSFC & SSC	Award education and research grants

ACCOMPLISHMENTS AND PLANS

In FY 2001, all Space Flight Centers will transition to a Full Cost budget environment. At this time the ETB budget will be phased out. Under Full Cost environment, ETB activities will be planned, justified and budgeted for by the benefiting customer receiving the service. All OSF Centers previously providing these ETB services will define and establish service pools and usage costs in order to recover operating costs. Service pools will be established for testing services, science and engineering laboratory capability, and computer operations. OSF Centers will continue to provide the highest quality science and engineering analyses for NASA's programs and external customers.

In FY 2001, ETB will support establishment of new budget line items for Rocket Propulsion Testing by transferring the portion of ETB budget supporting propulsion testing.

In FY 2001, establishment of a new budget line item for Center investments for facilities, laboratories, and equipment upgrades to maintain a state-of-the-art. A major investment initiative at MSFC is the Advanced Propulsion Research Center that allows us to conduct basic research that will lead to major advances in propulsion technology. In FY 2001 MSFC will maintain ETB's institutional base requirements funding; award education and research grants to Historically Black Colleges and Universities (HBCU) to promote science and technology; maintain highly skilled Safety and Mission Assurance contractor workforce to conduct assessment of conformance to reliability and quality standards; maintain technical core capability to provide in-depth technical support for research, design, development, mission operations, and evaluation; and ETB funding for Propulsion Testing will transfer from MSFC to SSC.

In FY 2001, JSC's efforts will continue to focus on maintaining the multi-program use science and engineering laboratories and facilities operational readiness. This effort will include performing scheduled facility infrastructure sustaining maintenance, maintaining analytical tools readiness, and performing the necessary repairs, modifications, and replacements to the facilities infrastructure to accommodate the changes needed to support program commitments. FY2001 contains many critical programmatic milestones that will require extensive use of our laboratories and facilities. NASA will continue to need to perform critical studies, test, and analyses for many activities. These include: monitoring human life support and crew health as crews continue to inhabit ISS, ensuring the Shuttle can safely operate and transport Station hardware and astronaut personnel, and ensuring smooth and safe operations of personnel and equipment during the Station assembly EVAs. ETB will also keep the laboratories and facilities operational to perform exploration and development studies.

In FY 2001, KSC Materials Science Laboratory will continue providing analysis and test support to Shuttle, Space Station, Reusable Launch Vehicles, Payloads and Life Sciences programs. In the area of technology development, the KSC Materials Science Laboratory will establish Electrostatic Discharge and Corrosion Engineering Testbeds.